Thermal Conductivity and Thermo E.M.F. of CuInSe₂ Films Prepared by Condensation in Vacuum Method

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The growing interest in the thermoelectrical properties and thermal conductivity of CuInSe $_2$ is motivated by the prospect of developing new materials with technological applications such as composite films for photo and hermoenergetic processes. In this paper we present results of a study of the thermal conductivity and Seebeck effect of thin films of CuInSe $_2$ prepared by hot wall methods. The p-type films with 10^{15} - 10^{18} cm $^{-3}$ charge carrier density and 10^{-3} -0.6 Ω electrical conductivity of thickness 1-4 μ m were prepared on a substrate with screen temperatures of 500-700 K. Ohmic contacts of In were evaporated in high vacuum. The quality and the composition of the films were controlled by XRD and XRMA methods. Single phase stoichiometric films with halcopirite structure had 0.5-0.7 μ m grain size. For measuring the thermal conductivity, a deposited thin film of nickel strip in the surface of the sample was used as a heat source and as a temperature sensor. A string of square pulses via an ac coupled circuit with an internal resistance of 100 ohm was produced with a pulse generator. Agreement between our data for thermal conductivity previously using a shorter and different method is good. Thermal measurements were made in a planar geometry at various temperatures in the range 80 - 300 K. The samples with the highest value of 420 μ v/K at room temperature are those with the smallest density of mobile charge carriers. Calculation of the effective mass of the holes at 300-350 K yields consistently the value m = 0.76 m $_0$ in agreement with results from microwave measurements.